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Contourite processes associated to the Mediterranean Outflow Water after its exit from the Gibraltar Strait: global and conceptual implications

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Herein we report characterization of the proximal sector of the Gulf of Cadiz after the Strait of Gibraltar using a novel multidisciplinary approach that combines oceanographic, morphosedimentary and stratigraphic studies and incorporates new oceanographic, geophysical and geological data. Two terraces (upper & lower) have been identified along the middle continental slope. They comprise several associated morphologic elements, including two large erosive channels, which determine a new and more detailed understanding of the Mediterranean Outflow Water (MOW) pathway and deceleration. There is evidence for along-slope circulation in addition to a secondary circulation oblique to the main flow. The present upper core of the MOW flows along the upper terrace in the proximal part of the middle slope, and the present lower core flows along the lower terrace. However, the lower terrace shows largest and better defined erosive features on the seafloor, which we attribute to a denser, deeper and faster MOW circulation that prevailed during cold-climate intervals. Development of the present features started at ∼3.8 to 3.9 Ma, but the present morphology was not established until the Late Pliocene-Early Quaternary (3.2 to >2.0 Ma), when the MOW enhanced, coeval with global cooling, a sea-level fall and an increase in Thermohaline Circulation. We propose a direct link between the MOW and the Atlantic Meridional Overturning Circulation (AMOC) and hence, between the MOW and both the Northern Hemisphere and the global climate. Our results have enabled a better understanding of depositional features related to oceanic gateways.